STRATEGIC FRAMEWORK FOR INFORMATION WARFARE: TASK 4, THE DEVELOPMENT OF INFORMATION STRATEGY

John Arquilla, Associate Professor
Information Warfare Academic Group
Sponsor: RAND Corporation

OBJECTIVE: The "information strategy" project will develop a framework for analyzing the manner in which emerging information technologies may either serve as useful adjuncts to political, military and economic policies, or may form a distinct new "information strategic" dimension.

DoD KEY TECHNOLOGY AREA: Other (Information Warfare)

KEYWORDS: Information Warfare, Information Technologies

CHINESE BUDGETARY AND DEFENSE PLANNING PRIORITIES

John Arquilla, Associate Professor
Information Warfare Academic Group
Sponsor: Office of the Secretary of Defense

OBJECTIVE: Through processes of economic revitalization and institutional redesign, China has begun to actualize its enormous potential as an emerging great power. This will have major effects upon the world economy, but also on the nature of international security. A key aspect of China's rise as a military power will be the manner in which its economic growth as concomitant effects upon defense planning and budgetary processes. This project, therefore, will perform research in the area of determining Chine defense spending priorities for the near-and-long term future. The focus of this study will be on assessing the degree of preference being shown for spending that supports two areas of operations: force projection and information warfare. The research performed in this study will rely upon primary source materials provided primarily by means of field research activities.

DoD KEY TECHNOLOGY AREA: Other **(**Advance Telecommunication)

KEYWORDS: Information Warfare, Defense Budgetary Processes

INFORMATION OPERATIONS MODELING AND SIMULATION (IO M&S)

Vicente Garcia, National Security Agency Cryptologic Chair
CAPT James Powell
Information Warfare Academic Group
Sponsor: National Security Agency

OBJECTIVE: To develop a decision aid and methodology for modeling and simulating a decision-making influence network.

SUMMARY: NPS has applied SAIC's SIAM Influence Net Modeling Tool to Evident Surprise scenarios along with innovative IO options to address the requirement for Information Operations modeling and simulations. IO M&S has been a top three recommendation from ACOM's Evident Surprise IW/IO exercise for the past two years. An influence net model of a targeted country has been constructed with the assistance of SAIC and the ACOM J5. Developmental IO options integrated and the interaction and effects on leadership have been effectively demonstrated. The result is a first-look simulation of how leadership can be influenced by IO in real-world contingencies. Refinement of intelligence via Intelink and open sources from the Internet, along with strengthening causal relationships, is ongoing. NPS student and faculty developers have demonstrated the results of this analysis to CINCUSACOM, CINCUSNAVEUR, DIRNSA, GEN J.J. Sheehan, USMC

(ret.), and other high-level decision-makers to show SIAM's value as an IO influence modeling and decision aid, and modeling and simulation research tool.

DoD KEY TECHNOLOGY AREAS: Modeling and Simulation, Other (Information Operations)

KEYWORDS: Information Warfare, Information Operations, Modeling and Simulation, Influence Network

NPS NETWORK RESEARCH LAB
Vicente Garcia, National Security Agency Cryptologic Chair
CAPT James Powell
Information Warfare Academic Group
Sponsor: National Security Agency

OBJECTIVE: To understand and develop methods and tools to defend against external and internal computer network attacks.

SUMMARY: The NPS Network Research Lab supports Information Operations research in evaluating and demonstrating the vulnerability of network technologies from operating systems to network management tools to attack. This effort consists of information about the vulnerabilities of the entire scope of network technologies, research into, and demonstrations of the vulnerability of various technologies to attack methods and scenarios, and in depth analysis of network technologies focusing on end-to-end vulnerabilities.

DoD KEY TECHNOLOGY AREAS: Other (Information Warfare, Computer Network Attack/Defense)

KEYWORDS: Information Warfare, Information Operations, Computer Network Attack

THESES DIRECTED:

Collom, K.S. and Craig, J.E., "A High Power Microwave Application for Information Operations, Master's Thesis, Naval Postgraduate School," September 1997.

Buettner, R.R. and Harris, R.B., "A Comparative Analysis of Commercial-off-the-Shelf Software for use in Transmitting Sensitive but Unclassified Data," Master's Thesis, Naval Postgraduate School, September 1997.

Burns, E.J., "Performing Stand-Off Jamming using Global Hawk Unmanned Aerial Vehicle," Master's Thesis, Naval Postgraduate School, September 1997.

Frizzell, C.L., "Strategic Impact of Iranian Data Communications Upgrades," Master's Thesis, Naval Postgraduate School, September 1997.

Wilson, A.N., "Tactical Unmanned Aerial Vehicles used as Stand-In Jamming Platforms," Master's Thesis, Naval Postgraduate School, September 1997

CURRICULUM DEVELOPMENT IN TACTICS, DOCTRINE, AND OPERATIONAL ANALYSIS

CAPT James Powell
Information Warfare Academic Group
Sponsor: Naval Engineering Logistics Office

OBJECTIVE: These funds will enhance the NPS students tactical development and education, specifically: support expanded use of Navy tactical information compendium at NPS. Support faculty in their research of the uses of microcomputers, simulations, and processes of Information Warfare (IW) and other simulations and associated data bases. Provide for the education of the faculty in areas of IW and joint tactics and doctrine. Provide support for NPS students and faculty doing thesis and research work in modeling, simulation, and wargaming (e.g., CVBG force projection, C4I, IW simulations, modeling, and intelligence support) at commands involved with analysis and doctrine development (e.g., NraD, TACTRAGRU, Naval War College, NAWC-WPNS, China Lake, NADC, CAN, NDU, Naval Doctrine Command, etc.). Provide for student, faculty and chair participation in such events as NWCS war games, ARPA projects, and tactical symposiums. Such participation is for the development of subjects suitable for student theses and faculty research in the technical, tactical, and doctrine area.

DoD KEY TECHNOLOGY AREAS: Command, Control, and Communications, Modeling and Simulation

KEYWORDS: Information Warfare, Information Operations

WIDEBAND DIGITAL COMPRESSIVE RECEIVERS

D. Curtis Schleher
Information Warfare Academic Group
Sponsor: Secretary of the Air Force

OBJECTIVE: To investigate the application of digital pulse compression techniques to compressive receivers with an objective of increasing the overall bandwidth available from these receivers. Simulate an advanced digital wideband receiver with 8 GHz bandwidth using 1 GHz digital components and determine its bandwidth potential and sensitivities.

SUMMARY: Compressive receivers are advantageous in SIGINT applications requiring wide bandwidth in a dense emitter environment. Present implementations are limited in bandwidth by the analog nature of the design which requires a wideband dispersive delay line and also by the necessity of reading the output data at a digital rate which corresponds to the receiver's bandwidth.

This research describes a wideband digital compressive receiver which mitigates the limitations in the conventional analog design. A new stepped-frequency 8 GHz bandwidth digital design using 1 GHz sub-Nyquist sampling is described. The design was successfully demonstrated using MATLAB simulation. A bandwidth of 8 GHz was achieved using digital components which ran at a maximum 1 GHz clock rate. A 32 MHz resolution was measured as was the capability of separating 25 simultaneous signals occurring at the input of the receiver.

The bandwidth potential of this design was estimated as 16 GHz using 1 GHz digital components. Further research is required to realize the full potential of this design.

DoD KEY TECHNOLOGY AREAS: Electronic Warfare, Modeling and Simulation

KEYWORDS: SIGINT, Compressive Receiver, Digital Pulse Compression

INFORMATION WARFARE APPLIED TO THE JOINT C2W ATTACK MISSION

D. Curtis Schleher, Professor
Information Warfare Academic Group
Sponsor: Naval Postgraduate School

OBJECTIVE: To perform an independent technical study to identify a system which is capable of performing the joint C2W Attack Mission in the time period from the year 2000 to 2020.

SUMMARY: Under this research project, Unmanned Vehicles were identified as ideal platforms to perform the C2W attack missions. Two approaches were considered. In the first, the Global Hank UAV was determined to have the necessary capacity and infrastructure to support the jamming mission. It was determined that this could be accomplished as an adjunct to its normal reconnaissance mission. Connectivity was improved over using conventional airborne assets due to its wideband data link and satellite connection.

The second approach used a small Predator UAV to accomplish "stand-in" jamming. An EW package using a small phased array antenna was investigated. This also was effective, but requires further study to determine tactics and deployment concepts.

THESIS DIRECTED:

Burns, E., "High Altitude Endurance Unmanned Aerial Vehicle used as a Stand-Off Jamming Platform," Master's Thesis, Naval Postgraduate School, June 1997.

Wilson, A., "Tactical Unmanned Aerial Vehicle used as Stand-In Jamming Platforms," Master's Thesis, Naval Postgraduate School, June 1997.

DoD KEY TECHNOLOGY AREAS: Electronic Warfare, Command Control and Communications

KEYWORDS: Unmanned Aerial Vehicles, Stand-Off Jamming, Stand-In Jamming

INVESTIGATION OF HARD-KILL - SOFT-KILL INTERACTIONS

D. Curtis Schleher, Professor
Information Warfare Academic Group
Sponsor: Program Executive Office-Theatre Air Defense

OBJECTIVE: To investigate the interactions of soft-kill weapons (jammers, decoys, etc.) with hard-kill weapons (guns, interceptor missiles, etc.) in an air defense environment. Identify and catalog all potential interactions of each soft-kill system with each hard-kill system.

SUMMARY: Soft-kill and hard-kill mechanisms were identified and described. It was determined that interactions can occur in several ways, depending upon: 1) the role of the weapon (whether the weapon is the cause or the victim), 2) the nature of the interaction, direct or indirect, or 3) the number of ships and weapons involved in the engagement. An interaction polygon was developed which allows the various interactions to be visually displayed.

If hard-kill and soft-kill weapons are operated semi-independently, it was determined that both negative and positive interactions can occur, often unexpectedly and without being understood. Even beneficial effects of hard-kill/soft-kill integration are not necessarily advantageous if the commander lacks the knowledge of how to exploit them. A neural network approach is described which allows hard-kill/soft-kill mechanisms to be integrated into a single ship's defense system.

DoD KEY TECHNOLOGY AREA: Electronic Warfare, Conventional Weapons

KEYWORDS: Electronic Combat, Countermeasures, Air Defense Weapons, Hard-kill, Soft-kill

INDEPENDENT TECHNICAL ANALYSIS OF FLEET ASCM TRAINING SIMULATOR

D. Curtis Schleher, Professor
Information Warfare Academic Group
Sponsor: Naval Air Warfare Center-Indianapolis

OBJECTIVE: Anti-shipping missiles are a major threat to ships, particularly in the littoral environment; the Fleet Organic at Sea Training System needs to be upgraded to reflect threats and requirements through the year 2020. Through independent analysis, identify a functional simulator system which satisfies U. S. Navy and Amphibious Ready groups' anti-ship cruise missile training requirement in the years 2000 to 2020.

SUMMARY: Under this research project, an independent technical analysis of an improved ALQ-170 simulator was conducted. The analysis resulted in the identification of a preferred system design capable of providing anti-ship cruise missile (ASCM) defense training through the years 2000 to 2020.

The research used a system engineering approach to identify a preferred system design. A balanced set of requirements were determined on the basis of the Operational Requirement Document (ORD) and fleet messages. Measures of Effectiveness (MOE) and Measures of Performance (MOP) were determined from the requirements. A top level functional decomposition was performed to identify critical elements of the system. Four design alternatives were synthesized which range from a modification of the current design to a fully coherent, multi-polarization, broad band simulator with "dial-a-threat" capability.

The various design alternatives were examined through a series of trade-off analysis studies. Preferred solutions for critical components of the transmitter, antenna, receiver and system characteristics were developed. A decision matrix method was used in the trade-off studies where weights were related to a prioritized set of system performance measures. A preferred solution was identified which used helix TWTs supported by a wide band quadridge multi-polarization horn fed reflector antenna.

THESIS DIRECTED:

Goldsmith, G. L., "System Analysis of New ASCM Simulator," Master's Thesis, Naval Postgraduate School, March 1997.

DoD KEY TECHNOLOGY AREAS: Air Vehicles, Modeling and Simulation

KEYWORDS: Anti-Ship Cruise Missile, Simulator, System Engineering